Second Language Acquisition and Technology: A Review of the Research

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Foreign language (FL) teachers have always been ahead of the curve in integrating technology in FL instruction and learning, seeing the benefits of technology even without an extant research database to confirm their judgment. The number of computer applications, communications technologies, and sheer volume of offerings on the Internet has grown at an amazing rate over the past 15 years, and many FL educators, heeding instinct, common sense, and anecdotal information, have embraced these new technologies as useful instructional tools. There is, however, a small but increasingly vocal cadre of second language acquisition (SLA) researchers who question whether the use of new technologies in language instruction furthers second language acquisition (Chapelle, 1997; Cubillos, 1998; Ervin, 1993; Garrett, 1991). Researchers lament the lack of sufficient empirical evidence to support this general belief (Burston, 1996; Salaberry, 1996) and have attempted to collect such evidence through literature reviews and calls for principled and theoretically based studies (Chapelle, 1997; Liu, Moore, Graham, & Lee, 2002; Warschauer, 1997; Zhao, 1996).

Conceptual Framework

Before discussing the effects of technology use on SLA, we must first delineate a theoretical perspective through which to view the research. While there are several competing theories of SLA, much of the research supports an interactionist position, underscoring the concomitant effects of the external linguistic environment and internal individual learner variables on language acquisition (Ellis, 1994; Larsen-Freeman & Long, 1991). The tenets of comprehensible input, intake, output, negotiation of meaning, and attention to both form and meaning are posited to have an impact on a learner's interlanguage progression. Sociocultural perspectives on language learning, as influenced by the work of Vygotsky (Lantolf & Appel, 1994; Warschauer, 1997), provide a complementary position that considers language learners in direct relation to their social and cultural surroundings and condition. This theoretical background—reflecting both interactionist and sociocultural perspectives on second language acquisition—will frame the discussion in this digest.

While a broad range of technologies may support teaching, this digest will examine those technologies involved in computer and Internet use for purposes of FL instruction and learning and will use the term *CALL* (computer-assisted language learning) to include "the search for and study of applications of the computer in language teaching and learning" (Levy, 1997).

Problems with the Research Base

Lack of consensus. Researchers have yet to come to agreement on just what promotes and what hinders SLA. Much of the technology research base is centered on the investigation of computer use that facilitates or promotes those things that we believe aid language acquisition (e.g., interaction, target language input and output, acculturation, motivation) rather than on the measurement of outcomes. Therefore, much of the research base deals with analysis of learner discourse, self-report data, and qualitative surveys on affective reactions to technology use. Whether or not a causal relationship exists between these variables and learning outcomes or even if they are relevant influences remains a matter of speculation by researchers.

Limited population of subjects. Most research on SLA and technology use has been carried out using subject populations at the college level. Very little research in this area has been done at the K-12 level, but this is where most language instruction takes place in the United States.

Mixed methodologies. Some studies are qualitative while others are quantitative. Many analyses combine an array of studies, including some that are purely experimental and others that employ descriptive statistics. Mixed methodologies and heavy reliance on self-report data present additional difficulties in categorizing and generalizing across studies.

Impact of the technology medium. Many studies fail to take into consideration or control for the potential negative effects of computer use in terms of inexperience or aversion, such as for students with limited word processing skills. Potential short-term "false positive" or inflationary results stemming from the sheer novelty of computer use for normally mundane but necessary language learning tasks are often overlooked as well. There is also some evidence that CALL represents a *different* mode or form of communication than that occurring without computer technology. The resulting data from these studies should be analyzed with that in mind.

What Does the Research Indicate?

Sociocultural issues. From a sociocultural perspective, much of the research demonstrates the ability of CALL to provide an arena for natural, meaningful, and realistic language production and reception between and among native and nonnative speakers of the target language. Language learners engaged in computer-mediated contact with others—for example, in chat rooms where writing becomes speaking—tend to produce more language than in face-to-face discussions. In addition, participation appears to be equalized across learner populations; that is, the discussion is not dominated by a small number of students, as often occurs in the regular classroom. This may be due to the reduction of social context clues and nonverbal clues that tend to inhibit participation. There is also a greater ratio of student talk to teacher talk. Researchers cite a marked increase in cultural awareness on the part of students as well. (See Cubillos, 1998; Gray & Stockwell, 1998; Liu et al., 2002; Ortega, 1997; Salaberry, 1996; Singhal, 1998; Warschauer, 1997; Warschauer & Healey, 1998; Zhao, 1996.)

Affect. Language learners report a positive attitude toward computer use overall when engaged in language learning tasks. Use of email for interaction, for example, appears to reduce anxiety and increase motivation. Indeed, nearly all studies in the literature reviews report positive student attitudes as defined by lower anxiety levels, higher interest, and greater student participation. In particular, learners express a preference for tasks that promote social interac-

tion between and among native speakers and nonnative speakers. (See Gray & Stockwell, 1998; Liu et al., 2002; Singhal, 1998.)

Language awareness. The use of CALL—for example, writing assistant software programs such as Daedelus InterChange—can help learners become more aware of errors and their nature so that they can monitor them in the future. In addition, instructors can use learner data produced through CALL to monitor progress and identify salient features in learners' interlanguage. (See Cubillos, 1998; Warschauer, 1997.)

Nature of language production. There is some evidence that the language produced while engaged in CALL is qualitatively better, more coherent, cohesive, and expressive than the language learners produce in face-to-face classroom communication. There is also some indication that language learners engage in a wider variety of discourse functions and that the modifications in speech that necessarily derive from an interactionist perspective are present in greater number in CALL tasks. (See Chapelle, 1997; Cubillos, 1998; Liu et al, 2002; Ortega, 1997; Warschauer, 1996, 1997.)

Language skills. Writing is perhaps the skill most investigated by SLA researchers. As indicated above, language learners demonstrate increased target language production when using writing assistants (e.g., *Système-D, Atajo, Quelle*). This increased production is sometimes judged to be qualitatively better than that produced without the use of computer assistance, but the results are not unanimous in this regard. (See Chun, 1994; Gray & Stockwell, 1998; Hyland, 1993; Kern, 1995; Liu et al., 2002; Singhal, 1998; Warschauer, 1997; Warschauer & Healey, 1998.)

Very few studies concentrate specifically on the skill of listening. Clearly one benefit of CALL in this area is the increased access to target language input presented in a variety of ways. The multimedia capabilities of CALL enable learners to engage in a complex listening experience, complete with visual cues from the interlocutor. The greatest advantage touted in research on listening and CALL is that the multimedia nature of the activities addresses the use of different modalities, thus appealing to a wider variety of learning styles. (See Liu et al., 2002.)

Few studies focus on speaking, though speech recognition software has been explored as a possible aid to language learning. The general consensus is that, while this software shows promise for future research, it is not yet sufficiently developed or reliable to justify its use in FL studies. (See Liu et al., 2002.)

As for studies on the use of CALL to improve reading skills, the primary emphases have been the use of glosses and vocabulary acquisition. In both areas, students using computer technologies to assist in comprehending reading passages and identifying vocabulary outperformed control groups of students who did not have this assistance available or chose not to use it. (See Cubillos, 1998; Liu et al., 2002.)

Additional Thoughts on SLA and Technology

More important than the use of technology per se is the quality of what is done with this medium. A badly conceived interactive task or activity is poor whether it is done on a computer or face to face. Using technology is not enough. In order to promote successful learning, tasks must be meaningful, have a true interactional component, and have a comprehensible purpose for the language student (Chapelle, 1997; Liu et al., 2002; Warschauer & Healey,

1998). Future CALL research endeavors should begin with this premise.

Note: As a complete literature review with concomitant references is far beyond the scope of this digest, several overarching issues are addressed, and some general research-based results are discussed. The reference section offers several extensive literature reviews and SLA books for additional reading.

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